

REMARKS

Claims 1 - 3, 5 - 7, 9 and 10 remain active in this application. Claims 4, 8 and 11 - 16 have previously been canceled. Amendment of claim 1 has been requested to re-insert punctuation inadvertently removed in the previous amendment. No new matter has been introduced into the application.

Claims 1 - 3 and 5 - 7 have been rejected under 35 U.S.C. §103 as being unpatentable over Colgan et al in view of Shue et al. and Uzoh (the Examiner now asserting that claims 2, 3 and 10 are product-by-process claims due to the recitation of PVD tungsten or silane based high density plasma oxide) and claims 9 - 10 have been rejected under 35 U.S.C. §103 as being unpatentable over the same combination of references in view of the further teachings of Jain. Both of these grounds of rejection are respectfully traversed for the reasons of record, hereby fully incorporated by reference, and the further remarks provided below.

To summarize arguments previously presented, Colgan et al. is directed to control of the effects of metal migration in an environment superficially similar to that of the present invention by providing "a continuous path for copper and aluminum atoms to move in the interconnect structure" (Abstract, last sentence) and the interposition of a barrier in that path in the manner of the present invention, as claimed, would prevent that function and thus preclude operation of Colgan et al. in the intended manner. Likewise, it was previously pointed out that while Uzoh may mention the use of some of the materials recited in the present claims, Uzoh is concerned with developing a "single crystalline conductor material extending through the structure" and does so by "utilizing an open-bottomed via liner structure, as noted in the Abstract, column 2, line 43, and elsewhere in Uzoh.

Note also in Figure 2(b) of Uzoh, layer 32 is, itself, preferably copper and has no protection applied thereto but, rather, merges with the metal of the stud 34, evidently during deposition of the stud 34 or subsequent annealing discussed at column 6, lines 12 - 30, as shown in Figure 2(c). Again, like Colgan et al., the interposition of a barrier such as by closing the bottom of the liner in the via opening would preclude the intended formation of a single crystalline structure extending through the structure. Therefore, it is respectfully submitted that neither of these references teach or suggest the claimed structure including "a multi-layer barrier liner in said opening...and resists interdiffusion of copper and tungsten" and any suggested modification of the structure of either reference to answer such a recitation would be improper under the precedent of *In re Gordon*, 221 USPQ 1125 (Fed. Circ., 1984), to which the Examiner's attention is respectfully called, since any such modification would clearly preclude the intended function and meritorious effect of either reference *by the very fact that, as explicitly recited, the liner presents a barrier*. It is thus irrelevant what Shue et al. may teach or suggest in regard to any possible modification of either Colgan et al. or Uzoh. Moreover, as pointed out in the previous response, the Examiner has acknowledged that the combination of Colgan et al. and Shue et al. is insufficient to answer the recitations of the claims and the combination of including Uzoh would be improper and insufficient to answer the claims for the same reason as in regard to Colgan et al. since the presence of a barrier would be as inconsistent with the intended meritorious effect of Uzoh as it is in Colgan et al.

Further, none of these references taken singly or in any combination provides evidence of a level of ordinary skill in the art which would support a

conclusion of obviousness in regard to the subject matter of any claim in the application for the simple reason that they do not consider or even recognize the problem of attack of copper by the process materials used for the deposition of tungsten to create a via between copper and aluminum layers, much less lead to an expectation of success in obtaining a solution by the simple expedient of a multi-layer barrier layer, as claimed. Therefore, it is again respectfully submitted that the Examiner has failed to make a *prima facie* demonstration of obviousness of any claim in the application based on Colgan et al. , Uzoh and/or Shue et al.

In this regard, the Examiner's assertion that reference to PVD tungsten" or "silane based high density plasma oxide" renders dependent claims to be product-by-process claims, in particular, is respectfully traversed. Even if (*arguendo*) the Examiner's assertion were correct, it would not reduce the Examiner's burden of making a *prima facie* demonstration of anticipation or obviousness or shift the burden of proving differences therefrom to the Applicant in regard to independent claim 1 or other claims. Further, it is respectfully submitted to be well-established that materials deposited by different techniques often have different properties (e.g. different dielectric constant, different etch or diffusion rates, different densities and the like due, for example, to different grain structures) and, where that is the case, the method of developing such different materials *is commonly used as the name of the material*, as is respectfully submitted to be the case here. Therefore, it is respectfully submitted that the mention of PVD or a precursor material in an adjectival usage does not substantively or necessarily refer to a process at all, much less, by such a reference, alone, cause a claim to become a product-by-process claim,

especially where the clear intent is to recite a material which is distinct from other materials which may be compositionally the same but formed by different processes. That such is the case logically follows from the recognition in the art of the differences in properties due to different processes which *ab initio* satisfies the burden of showing differences which is the underlying rationale for special treatment of product-by-process claims where such recognition in the art of such differences is not presented.

In regard to Jain, it is respectfully pointed out that the Examiner relies upon Jain merely for the showing of a covering layer. However, the Examiner does not assert that Jain mitigates any of the deficiencies or improprieties of the combination of Colgan et al., Uzoh and Shue et al. discussed above. Therefore, the inclusion of Jain in regard to claims 9 and 10 does not correct the Examiner's failure to make a *prima facie* demonstration of obviousness in regard to the overall combination recited in these claim.

Accordingly, it is respectfully submitted that the grounds of rejection which the Examiner continues to assert are in error and untenable. In response to the Examiner's comments on remarks previously presented, it is respectfully submitted that the recognition of another advantage flowing naturally from following the suggestion of the prior art has nothing whatsoever to do with the impropriety of the combination of teachings as discussed above. The precedent of *In re Gordon*, *supra*, is basically a recognition that where the intended function of the prior art is precluded by the subject matter claimed in combination, any recognition of another advantage would not, in fact, flow naturally therefrom (but, rather, be unexpected and thus unobvious) and that there could be no motivation in the prior art but only through hindsight since intended functions and effects would be lost without leading to

an expectation of any other meritorious effect such as that achieved and supported by the invention, as claimed. Therefore, reconsideration and withdrawal of the grounds of rejection of record are respectfully requested.

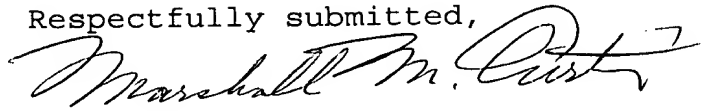
It is also respectfully pointed out that the amendments requested above are limited to the reinstatement of a single comma in claim 1 and thus cannot possibly raise a new issue. Moreover, the sole requested amendment is directed to a minor matter of form for which entry is explicitly provided in 37 C.F.R. §1.116. By the same token, while the absence of such punctuation was not raised by the Examiner, the correction thereof clearly reduces potential issues for appeal and entry is thus well-justified for that reason, as well. Further, it is respectfully submitted that the finality of the present action is premature since the *prima facie* propriety of the grounds of rejection asserted has not been demonstrated. Therefore, entry of the above-requested amendment is respectfully submitted to be in order for any and all of these reasons.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Deposit Account No.

09-0458 of International Business Machines Corporation
(E. Fishkill).

Respectfully submitted,

A handwritten signature in dark ink, appearing to read "Marshall M. Curtis", with a stylized flourish at the end.

Marshall M. Curtis
Reg. No. 33,138

Whitham, Curtis & Christofferson, P. C.
11491 Sunset Hills Road, Suite 340
Reston, Virginia 20190

(703) 787-9400
Customer Number: **30743**